

RATHER, A.I.

The E-201 hydraulic bucket excavator. Biul.tekhn.-ekon.inform.
no.12:36-37 '60. (MIRA 13:12)
(Excavating machinery)

RATNER, A.I.

Railroad cement tank car with pneumatic unloading. Biul.tekh.-ekon.
inform. no.1:61-62 '61. (MIRA 14:2)
(Cement—Transportation)

RATNER, A. I.

The D-392 semitrailer scraper. Biul.tekh.-ekon.inform.Gos.nauch.-
issl.inst.nauch.i tekh.inform. 16 no.4:39-41 '63. (MIRA 16:8)
(Scrapers)

PA 28T23

RATNER, A. I.

USSR/Engineering
Construction Machinery
Cements

Jan 1947

"What Construction Machinery Will Builders Receive in 1947," A. I. Ratner, Engr, 2 pp

"Stroitel'naya Promyshlennost'" No 1

One of the prime objectives of the Five-Year Plan is mechanization of labor in the construction industry. The article enumerates new types of machinery which are expected to be produced in 1947 for mechanizing ground work, extracting gravel, sand, clays and other materials, and for mechanizing cement work, crushing and sorting of materials. The approximate capacity of each new machine is given briefly.

BS

28T23

BUSHUNOV, V.T.; KOL'TSOV, N.I., kand. tekhn. nauk, retsenzent;
RATNER, A.I., inzh., red.; MIKHEYEVA, R.N., red.izd-va;
SIMONOVSKIY, N.Z., red.izd-va; SHCHETININA, L.V., tekhn.
red.

[Printing presses; designs and plans] Pечатnye mashiny;
raschet i proektirovanie. Moskva, Mashgiz, 1963. 614 p.
(MIRA 16:12)

(Printing press)

RATNER, A. I.

PA 28/49T36

USSR/Engineering
Construction Equipment
Construction Industry

Jun 48

"Review of the Publication of the Ministry of Construction and Road-Building Equipment, Glavstroymekhanizatsiya: List of Construction and Road-Building Equipment," A. I. Ratner, Engr, $\frac{1}{4}$ p

"Mekh Stroi" No 6

Work is valuable, but would be easier to handle if broken up according to types of equipment. Suggests this be done for subsequent printings. Recommended reading for all employees in the construction field.

FID

28/49T36

REBROV, A.S., inzh. [deceased]; USFENSKIY, V.P., inzh.; PLESHKOV,
D.I., kand. tekhn. nauk; BELEN'KIY, V.I., inzh.;
BERNADSKIY, G.I., inzh.; VALUTSKIY, I.I., inzh.; BAZANOV,
A.F., kand. tekhn. nauk; KOGAN, I.Ya., kand. tekhn. nauk;
RATNER, A.I.; VOROB'YEV, A.A., inzh.; BAUMAN', V.A., kand.
tekhn. nauk; NOSENKO, N.Ye., kand. tekhn. nauk; FOKIN,
M.V., inzh. [deceased]; VINOGRADOV, G.V., inzh.; GUSAKOV,
K.A., inzh.; SUDAKOVICH, D.I., inzh.; Prinimali uchastiye:
SIGAL', Ya.Ye., inzh.; TITOV, M.A., inzh.; OGIYEVICH, V.Ya.,
kand. tekhn. nauk; ZIMIN, P.A., kand. tekhn. nauk, retsenzent;
LAPIR, F.A., inzh., retsenzent; PETROV, N.M., kand. tekhn.
nauk, retsenzent; RYAKHIN, V.A., kand. tekhn. nauk, retsen-
zent; KHOLIN, N.A., inzh., retsenzent

[Construction machinery; a reference manual] Stroitel'nye
mashiny; spravochnik. Izd.3., perer. i dop. Moskva, Ma-
shinostroenie, 1965. 788 p. (MIRA 18:6)

RATNER, A.I.

The L-1510 trailer excavator. Bul. tekhn.-ekon. inform. no. 10:46-47
'59. (MIRA 13:3)

(Excavating machinery)

RATNER, A.I.

Mekhanizirovannyi ruchnoi instrument.
Vestn. Mash., 1950, no.8, p. 25-26.

Mechanized hand tool.

DLC: TNH.Vh

SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library
of Congress, 1953.

RATNER, A.I., inzhener

The kind of construction machinery builders will get in 1947.
Stroi. prom. 25 no. 1:23-24 Ja '47. (MLRA 8:12)
(Building machinery)

[illegible][illegible]

Journal of Management Education 30(6)

10. Mass Spectroscopy and Chemical Engineering in the Soviet Union,
Moscovskii et al., 1967.

RATNER, A. I. Eng

Conveying Machinery

Light duty belt conveyers. Vest. mash. 32, no. 1. '52.

Monthly List of Russian Accessions, Library of Congress, October 1952. Unclassified.

RATNER, A.I.

Machinery and equipment for industrial and housing construction at
the permanent All-Union Construction Exhibition. Stroi.prom. 33
no.2:41-45 F '55. (MIRA 8:4)
(Building machinery) (Moscow--Construction industry--
Exhibitions)

RATNER, A.I., inzhener.

Thirty-one-ton earth hauling truck (from "Construction Methods and Equipment," Je, 1955). Stroi. i dor.mashinostr. 1 no.2:36 P '56.
(MLRA 10:1)

(Earthmoving machinery)

RATNER, A.I., inzhener.

Lightweight multibucket excavators. Mekh.stroi. 13 no.5:30-32
My '56. (MLRA 9:8)

(Excavating machinery)

BEZHANOV, Boris Nikolayevich; RATNER, A.I., inzhener, retsenzent; GERTS, Ye.V.,
kandidat tekhnicheskikh nauk, redaktor; SIMONOVSKIY, N.Z., redaktor
izdatel'stva; SPERANSKAYA, O.V., tekhnicheskiy redaktor.

[Pneumatic machinery] Pnevmaticheskie mekhanizmy. Moskva, Gos.
nauchno-tekhn.izd-vo mashinostroi.lit-ry, 1957. 251 p. (MIRA 10:11)
(Pneumatic machinery)

RAT. 1B, A.1.

The BM-201 bucket excavator. Biul. tekhn.-ekon. inform. no.1:71-72
'57. (MIRA 11:4)

(Excavating machinery)

RATNER, A.I., inzhener.

New foreign road machinery. Stroiki dor.mashinostr.no.1:30-32 Ja
'57. (MLBA 10:2)

(Italy--Road machinery) (United States--Road machinery)

RATHER, A.I.

The D-168 motor scraper. Bul.tekh.-ekon.inform. no.4,43-44 '60.
(MIRA 13:11)
(Scrapers)

RATNER, A. I.

The K-255 25-ton capacity crane with pneumatic tires. Biul.tekh.-
ekon.inform. no.11:42-44 '60. (MIRA 13:11)
(Cranes, derricks, etc.)

S/193/60/000/010/010/015
A004/A001

AUTHOR: Ratner, A. I.

TITLE: The Diesel-Electric K-151 Autocrane

PERIODICAL: Syulleten' tekhniko-ekonomicheskoy informatsii, 1960, No. 10,
pp. 39-40

TEXT: The Kamyshinskiy kranovyy zavod (Kamyshin Crane Plant) in 1960 designed and built a pilot model of the full revolving diesel-electric K-151 auto-crane with a lifting capacity of 15 tons, intended for structural and mounting operations, as well as loading and unloading operations of piece goods and loose material. Boom length of the crane amounts to 10, 18, and 22 m, depending on local conditions. The crane operates with or without extensible props depending on the load to be handled. For the handling of large-sized loads weighing up to 2 tons and for mounting operations the crane boom can be fitted with tandems 3 and 5 m long, and with an auxiliary hook girdle, while for the handling of loose material it can be equipped with a grab bucket, weighing up to 3.7 tons (with the load). The crane is mounted on the chassis of the YAZ-219 (YAZ-219) truck with a two-stroke six-cylinder YAZ-M206A (YAZ-M206A) diesel engine of 180 hp. The

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S/193/60/000/010/010/015
A004/A001

The Diesel-Electric K-151 Autocrane

electric motors of the crane are supplied with three-phase current, voltage 400 v, from the own MCA 73/4A(MSA 73/4A) generator of 30 kva power, or from the outer network with a-c current of 380 v voltage. All operating units of the crane possess an individual drive with mechanical transmission to the operating units. Two operations of the following can be combined owing to the presence of individual drives: lifting and lowering of loads, lifting and lowering of the boom, turning the crane through 360°. The following technical specifications are given: lifting height (depending on the boom length) - 9.1-20.5 m; load lifting speed - 3 - 12.5 m/min; velocity of rotation of the revolving part - 0.5 - 1.5 rpm; traveling speed of crane on asphalt roads - 35 km/hour; on dirt roads - 20 km/hour; number of running wheels: swivelling front wheels - 2; rear driving wheels - 8; overall dimensions; height during transportation - 3,910 mm; total length during transportation - 14,000 mm; maximum width of crane - 2,740 mm; constructional weight (dry) - 20,800 kg. The table presents data on the lifting capacity of the crane depending on the boom length and boom from the pivoting axis.

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The Diesel-Electric K-151 Autocrane

S/193/60/000/010/010/015
A004/A001

А. Длина стрелы	В. Вылет от оси вращения, м	С. Грузоподъемность, т	
		на дополни- тельных опорах	без опор
10 м	4.1; 4.4; 5.3; 7; 10	15; 12.5; 9; 5.75; 3.25	4.25; 3.7; 2.8; 2; 1.2
18 м	5; 6; 8; 12; 17	8.25; 6; 3.85; 2.2; 1.3	2.4; 1.8; 1.22; 0.6; 0.235
22 м	7; 12; 17; 20	4.4; 2; 1.16; 0.9	2.15; 0.4
1. 18 м 22 м при работе с гуськом 3 м	13	2	—
2. 18 м 22 м при работе с гуськом 5 м	14	1.6	—

A. Boom length; B. Boom from Pivoting Axis in m; C. Lifting Capacity in tons;
D. on additional props; E. without props; 1. 18 and 22 m when operating with
3 m tandem; 2. 18 and 22 m when operating with 5 m tandem.
There is 1 figure and 1 table.

Card 3/3

RATNER, A. I.

Hannover Industrial Exhibition of 1957 (excavators and loaders).
Stroi. i dor. mashinostr. 2 no.11:38-40 N '57. (MIRA 11:1)
(Hannover--Excavators--Exhibitions)
(Hannover--Shoveling machines--Exhibitions)

AUTHOR: Ratner, A.I., Engineer

100-9-11/11

TITLE: Building Machines Used for Housing Developments
(Mashiny dlya zhilishchnogo stroitel'stva)

PERIODICAL: Mekhanizatsiya Stroitel'stva, 1957, No. 9,
pp. 27 - 31 (USSR).

ABSTRACT: A description and specifications of various types of building machinery, used and manufactured in Western Germany, are given. Excavators, bulldozers, drilling shafts, trench excavators, mechanical shovels, lorry-mounted mixers, water gauges for concrete mixers, building cranes, equipment for the application of rendering and steam generators are described. There are 13 figures and 7 tables.

AVAILABLE: Library of Congress

Card 1/1

1. Earth moving equipment-Specifications
2. Construction-Equipment-Specifications

RATNER, A.I., inzh.

Building machinery. Mekh.stroi. 14 no.8:26-31 Ag '57. (MIRA 10:11)
(Moscow--Building machinery--Exhibitions)

RATNER, A.I., inzh.

Machines for housing construction. Mekh.stroi. 14 no.9:27-31 S '57

(MIRA 10:11)

(Building machinery)

RATNER, A.I., inzh.

New machines facilitating the work of construction workers. Bezop. truda
v prom. 2 no.11:29-30 N '58. (MIRA 11:11)
(Building machinery)

RATNER, A.I.

The M-221 universal excavator. *Biul.tekh.-ekon.inform.* no.5:34-35

'58.

(MIRA 11:7)

(Excavating machinery)

RATNER, A.I.

The D-357G automotive scraper. Biul. tekhn.-ekon.inform. no.7:41-43
'58. (MIRA 11:9)

(Scrapers)

RATNER, A. I.

The S-386 motortruck for cement transportation. Biul. takhn.-
ekon. inform. no.8:77-78 '58. (MIRA 11:10)
(Motortrucks) (Cement--Transportation)

RATNER, A.I.

The D-369 grader-elevator. Biul.tekh.-ekon.inform. no.9:41-42 '58.
(MIRA 11:10)

(Graders (earth moving machinery)

RATNER, A.I.

The D-395 motor grader. Biul.tekh.-ekon.inform. no.9:72-73 '58.

(MIRA 11:10)

(Graders (Earthmoving machinery))

RATNER, A.I.

The K-106-type crane. Biul.tekh.-ekon.inform. no.11:50-52
'59. (MIRA 13:4)

(Cranes, derricks, etc.)

RATNER, A.I.

The S-570 motortruck for cement transportation. Biul.tekh.-
ekon.inform. no.12:65-66 '59. (MIRA 13:4)
(Cement--Transportation)

RATNIR, A.I.

The MZS-13 machine for driving screw piles and anchors. *Blul.tekh.-*
ekon.inform. no.6:40-41 '60. (MIRA 13:8)
(Piling (Civil engineering))

RATNER, A. I.

The D-505 semitrailer grader-conveyor. Biul. tekhn.-ekon. inform.
Gos. nauch.-issl. inst. nauch. i tekhn. inform. no. 12:45-47
'62. (MIRA 16:1)

(Road machinery)

-RATNER, A.I.

The S-489 vibrator. Biul.takh.-ekon.inform. no.11:44-45 '58.
(MIRA 11:12)

(Vibrators)

RATNER, A.I.

The KTS-5 crane for mounting contact-network poles. Biul.tekh.-
ekon.inform. no.1:73-74 '59. (MIRA 12:2)
(Cranes, derricks, etc.)

RATHER, A.I.

The D-451 semiturning loader. Biul.tekh.-ekon.inform. no.8:
41-42 '59. (MIRA 13:1)
(Road machinery)

AUTHOR: Ratner, A.M. SOV/70-3-6-14/25

TITLE: The Temperature Factor for the Scattering of X-rays in a Crystal of Rock Salt (NaCl) (~~Temperaturnyy faktor~~ rasseyaniya rentgenovskikh luchey v kristalle kamennoy soli)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 6, pp 740-742 (USSR)

ABSTRACT: The mean square amplitudes of the thermal oscillations of the ions in NaCl have been calculated as:

Na ions at high temperatures ($T \geq 90^\circ\text{K}$)

$$\overline{u}_{\text{Na}}^2 = 1.81 \times 10^{-20} T + 5.26 \times 10^{-17} T^{-1} - 5.37 \times 10^{-14} T^{-3} + 9.6 \times 10^{-11} T^{-5} \text{ cm}^2 .$$

At low temperatures ($T \leq 40^\circ\text{K}$)

$$\overline{u}^2 = 1.48 \times 10^{-18} + 4.18 \times 10^{-23} T^2 \text{ cm}^2$$

Card1/3

SOV/70-3-6-14/25

The Temperature Factor for the Scattering of X-rays in a Crystal of Rock Salt (NaCl)

Cl ion at high temperatures ($T \geq 90^\circ\text{K}$)

$$\bar{u}^2 = 1.87 \times 10^{-20} T + 3.42 \times 10^{-17} T^{-1} - 2.03 \times 10^{-14} T^{-3} + 2.3 \times 10^{-11} T^{-5} \text{ cm}^2$$

and at low temperatures ($T \leq 40^\circ\text{K}$)

$$\bar{u}^2 = 1.24 \times 10^{-18} + 4.36 \times 10^{-23} T^2 \text{ cm}^2 .$$

These functions are plotted with the region $40 - 90^\circ\text{K}$ interpolated. At 290°K the values are for Cl^- and Na^+ respectively 0.238 and $0.233 \text{ \AA}$ in agreement with Valler and Tames measurements of 0.22 and $0.24 \text{ \AA}$ (PRS, 117, 214, 1927). The calculation was made from the quantum mechanics of lattices and was computed at 512 points in the reciprocal cell.

Card 2/3

SOV/70-3-6-14/25

The Temperature Factor for the Scattering of X-rays in a Crystal of Rock Salt (NaCl)

The quoted values of $\bar{u}^2$ are related to the usual thermal factor by:

$$M_j = \exp \left[-8\pi^2 \bar{u}_{jn}^2 \left(\frac{\sin \theta}{\lambda} \right)^2 \right], \quad \bar{u}_{jn}^2 = \frac{1}{3} \bar{u}^2 \text{ (for NaCl)}$$

Acknowledgments to G.Ye. Zil'berman. There are 1 figure, 1 Soviet and 1 English reference.

ASSOCIATION: Khar'kovskiy filial IREA (Khar'kov Branch of IREA)

SUBMITTED: April 19, 1958

Card 3/3

L 29976-65 EWG(j)/EWA(k)/FBD/EWT(1)/EEC(k)-2/EEC(t)/T/EEC(b)-2/EWP(k)/EWA(m)-2/
EWA(h) Pn-4/Po-4/Pf-4/Pi-4/Pl-4/PeB IJP(c) WG

S/0051/65/018/002/0258/0266

ACCESSION NR: AP5005039

AUTHOR: Ratner, A. M.

TITLE: Polarization of laser radiation

SOURCE: Optika i spektroskopiya, v. 18, no. 2, 1965, 258-266

TOPIC TAGS: laser, stimulated emission, active medium, resonator, resonator cavity

ABSTRACT: The degree of polarization of laser emission from a solid substance containing luminescent impurity centers is investigated theoretically. Two components polarized in mutually perpendicular directions and perpendicular to the optical axis are considered. Assuming that one of the components is much more intense than the other, a ratio of the intensities of the two components is calculated as a function of anisotropy of the dipole moment and the pump power. An analysis is then conducted of resonators with plane and spherical mirrors. Expressions are derived for the angular and spectral energy distribution of the weaker component. Orig. art. has: 28 formulas and 3 figures. [CS]

ASSOCIATION: none

Card 1/2

L 29976-65

ACCESSION NR: AP5005039

SUBMITTED: 09Nov62

ENCL: 00

SUB CODE: Ec, Op

NO REF SOV: 003

OTHER: 004

ATD PRESS: 3196

Card 2/2

RATNER, A. M.

57-2-22/32

AUTHORS: Lukushkin, L. S. , Ratner, A. M.

TITLE: On the Problem of the Energy Resolution of Scintillation Counters. I. (K voprosu ob energeticheskom razreshenii staintilyatsionnykh schetchikov. I.)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 26, Nr 2, pp.345-350 (USSR)

ABSTRACT: In the recording of a monoenergetic beam of γ -quanta the impulse-distribution at the output of the scintillation counter forms a curve whose shape depends 1) on the conditions of light-collecting of the scintillator, 2) on the effects connected with the Compton quantum-scattering and 3) on the fluctuation-processes in the photomultiplier. These causes of deviation are here investigated jointly for the case of the scintillators most used - the cylindrical NaJ(Tl)-crystals - in combination with various types of photomultipliers. For determining the influence of the dimensions of the scintillator upon their resolving power a calculation of three crystals is performed here: Nr 1 - $r = 20$ mm, $h = 60$ mm, Nr 2 - $r = 30$ mm,

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57-2-22/32

On the Problem of the Energy Resolution of Scintillation Counters. I.

$h = 30$ mm, $R = 15$ mm, $b = 15$ mm. Three cases concerning different conditions between the indices of refraction of the crystal, the intermediate layer and the glass of the photomultiplier are investigated here: 1) $n_{21} = 1$, this is the case of an ideal optical contact between crystal and photomultiplier, 2) $n_{21} = 1.2$, this is the case of a photomultiplier with a photocathode (applied onto glass). A Vaseline oil with an index of refraction of 1.48 serves as intermediate layer here. 3) $n_{21} = 1.77$ - this is the case which corresponds to a photomultiplier with an internal photocathode. The calculations show that the deviation caused by the light-outlet is represented by a curve which according to its shape is very different from the Gaussian curve and largely contributes to the deviations of the counter. Yu. A. Tsirlin called the authors' attention to the importance of the problems treated here. G. Ye. Mil'berman conducted the work. There are 5 figures and 6 non-Slavic references.

ASSOCIATION: Khar'kov Branch IREA (Khar'kovskiy filial IREA)

SUBMITTED: June 28, 1957

AVAILABLE: Library of Congress

Card 2/2

1. Scintillation counters-Energy resolution 2. Crystals-Refraction

AUTHORS: Ratner, A. M., Kukushkin, L. S. 57-28-5-35/36

TITLE: On the Problem of Energy Resolution of Scintillation Counters. II
(K voprosu ob energeticheskom razreshenii stsintillyatsionnykh schetchikov. II)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 5, pp. 1121-1125 (USSR)

ABSTRACT: The present paper is a continuation of the work conducted by the authors (Reference 1) on the light accumulation in scintillators. It is devoted to the investigation of the influence of the Compton distribution of γ -quanta in crystals and the FEU (photoelectronic multiplier) spread on the energy resolution in scintillation counters. Here, the case of a collimated γ beam with an energy of 0.661 MeV (Cs^{137}), which was directed along the axis of cylindrical crystals, was investigated. The size of the crystals NaJ(Tl) was: 1) $r = 20$ mm, $h = 60$ mm; 2) $r = h = 30$ mm; 3) $r = h = 15$ mm. Just as in reference 1 the first and the third crystal were computed for three values

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On the Problem of Energy Resolution of Scintillation
Counters

57-28-5-35/36

of the relative refraction index at the boundary between the crystal and FEU (photoelectronic multiplier) $n_{21} = 1, 1,2, 1.77$ and the second crystal only for $n_{21} = 1.2$. An accurate solution of the problem is only possible by complicated computations. Therefore an approximate way of computation was employed, the so-called Monte Carlo method. As a control the distribution curves, which were determined for two beams each consisting of 200 γ -quanta, were compared. It appeared, that the results for all investigated crystals agree with sufficient accuracy. The numerical results concerning the distribution curves are compiled in a table. As a comparison, data on the light accumulation are given (Reference 1). The table shows, that the Compton dispersion reduces the spread, in particular in small crystals. In the case, when the dimensions of the crystal are great in comparison to the length of free passage of the γ -quanta, the flashes can be regarded as points. The distribution curves of such a crystal can be constructed easily and immediately by means of the same intensity curves given

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On the Problem of Energy Resolution of Scintillation
Counters 57-28-5-35/36

in reference 1 without employing the Monte Carlo method. The better resolution of the beam collimated in the direction of the axis can be explained by the fact, that the flashes are produced primarily in the vicinity of the crystal axis. The spread of light emission, however, is in this range somewhat less than in the entire circumference of the crystal. It is obvious, that in case of a not collimated γ -beam striking the upper face the magnitude of spread must be between the spread of the curves: 1 dV and the curves in figure 1. The authors are indebted to G. Ye. Zil'berman for his guidance.

There are 3 figures, 1 table and 6 references, 1 of which is Soviet.

SUBMITTED: June 8, 1957

1. Scintillation counters--Design

Card 3/3

21.5300

66366

AUTHOR: Ratner, A.M.

SOV/120-59-5-9/46

TITLE: Average Light Output of Scintillators

PERIODICAL: Priory i tekhnika eksperimenta, 1959, Nr 5,
pp 44 - 47 (USSR)

ABSTRACT: A calculation is given of the light output of a scintillator averaged over its volume. The scintillator is in the form of a cylinder such that its height and radius are equal. The average light output is calculated as a function of the light-absorption coefficient in the scintillator μ , its radius R , the diffuse reflection coefficient from the upper surface of the scintillator λ_1 and, from the sides λ_1 , and the relative refractive index n_{21} of the scintillator and the liquid used to obtain an optical contact between the scintillator and the photo-multiplier. The results are given for n_{21} between 1.0 and 1.2. It is assumed that the scintillator surface reflects diffusely, i.e. according to a $\cos \theta$ law.

Card1/3

66366

SOV/120-59-5-9/46

Average Light Output of Scintillators

It is assumed in the calculation that each of the parts of the scintillator surface, i.e. the cylindrical surface and the two plane surfaces, are eliminated uniformly and that in the absorption calculation $\exp(-\mu r)$ may be replaced by $\exp(-\mu R)$. These simplifications introduced only a small correlation. Formulae are derived (Eqs 3-5) for the average amount of light leaving the scintillator. It is shown that large-volume scintillators do not always give the best light output. For example, scintillators with $R = 2$ cm give a greater output than a scintillator with $R = 5$ cm. The light output may be assumed with the aid of the formulae given by Eqs (3)-(5).

Acknowledgments are made to G.Ye. Zil'berman for valuable discussions and to A.P. Kilimov and L.L. Nagornaya for supplying the experimental data. There are 2 figures, 2 tables and 3 references, 2 of which are Soviet and 1 English.

Card 2/3

66366

SOV/120-59-5-9/46

Average Light Output of Scintillators

ASSOCIATION: Khar'kovskiy filial Vsesoyuznogo nauchno-issledovatel'-
skogo instituta khimicheskikh reaktivov (Khar'kov Branch
of the All-Union Scientific Research Institute for Chemical
Reagents)

SUBMITTED: September 11, 1958

4

Card 3/3

66275

SOV/181-1-11-10/27

~~24(7)~~ 24,3500

AUTHORS: Ratner, A. M., Zil'berman, G. Ye.

TITLE: Luminescence of Impurity Centers. I

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 11, pp 1697-1706 (USSR)

ABSTRACT: The present paper begins with an introductory discussion of the respective publications by Pekar and Krivoglaz (Refs 1-4), which are based on the assumption that the "law of mirror symmetry" is applicable. The papers by Williams (Refs 5-7) are then reviewed, and mention is made of the various restricting assumptions made by other authors. In the present paper the authors attempt to give a mathematical representation of the absorption- and luminescence spectra, without applying any of the restrictions mentioned to the theoretical representation. The only fundamental restriction consists in the calculation being made in adiabatic approximation, i.e. the assumption that the nuclei (ions) in the "crystal" (these considerations, however, are valid also for amorphous or liquid luminophors) move slowly with respect to the electrons, and that every nuclear configuration corresponds to a certain steady electron state. Agreement with these assumptions is satisfactory, since the bond energy of the electrons exceeds the quantity $\hbar\omega_1$ (where

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SOV/181-1-11-10/27

Luminescence of Impurity Centers. I

ω_1 = frequency of lattice vibrations) by two orders of magnitude. Ion movement is studied classically. It is further assumed that the shifts of nuclei from the position of equilibrium are so small that anharmonic vibrations can be neglected. The impurity concentration should be sufficiently low to enable the mutual interaction of impurity centers to be neglected. This condition replaces the demand for low concentrations of the excitation centers of luminescence if the additional widening of spectra, caused by inhomogeneous surroundings of the impurity centers, is small in comparison to the half-width of the spectra. It was shown experimentally that the concentration may change within a comparatively large interval without affecting the shape of the spectra. For these concentrations the second condition is fulfilled. Formulas describing the spectral dependence of the absorption coefficient and the intensity of the light emitted are derived. Both changes in the equilibrium position of ions during electron transitions and changes in the moduli of elasticity of the lattice are accounted for. A relationship is set up between the changes in the modulus of elasticity and the deviations of the absorption- and luminescence spectra from mirror symmetry and the Gauss distribution curve.

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Luminescence of Impurity Centers. I

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SOV/181-1-11-10/27

It is shown that one may neglect changes in the moduli of elasticity only in cases in which the "law of mirror symmetry" is valid. Finally, the authors thank I. M. Lifshits for discussing the paper. There are 1 figure and 8 references, 5 of which are Soviet.

ASSOCIATION: Khar'kovskiy filial IRYeA
(Khar'kov Branch of the IRYeA)

SUBMITTED: February 25, 1959

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66276

SOV/181-1-11-11/27

~~24(7)~~ 24.3500

AUTHOR: Ratner, A. M.

TITLE: Luminescence of Impurity Centers. II

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 11, pp 1707-1716 (USSR)

ABSTRACT: The present paper, which is a direct continuation of the investigation described in reference 1, also treats of the movement of ions in the crystal lattice in classical approximation. Since the electrons in crystals move faster than the ions, these movements may be described in adiabatic approximation. However, one must take into consideration the fact that the limitation of the velocities of ions causes a certain deviation from the adiabatic character which again leads to electron transitions between different levels. These transitions, which take place under the influence of thermal lattice vibrations, are designated as thermal or non-radiative transitions. In the present paper the probability of these transitions is calculated. Both the shift of ions from their positions of equilibrium as well as changes in the moduli of elasticity in electron transitions are taken into consideration. The restricting assumptions are the same as in reference 1, i.e. low concentration of excited centers and neglect of anharmonic lattice vibrations. Transitions of

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Luminescence of Impurity Centers. II

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electrons between two discrete levels due to the existence of an impurity atom are investigated. These results may be applied approximately to a transition between a discrete level and a band, e.g. to the thermal dissociation of electron capture centers. Actually, this transition should take place from one discrete level to the nearest band level, since the energy of activation for a thermal transition between two levels generally increases with increasing distance between them. Since the crystalline structure does not enter into the calculation, the results may be applied also to amorphous and liquid lumino-phors. Formulas describing the relationship between the shape of the absorption- and luminescence spectra and the probability of thermal transitions are set up. Allowance for the changes in the modulus of elasticity proves to be essential for the results. In the last part of the paper the author compares qualitatively the theoretical with the experimental data and investigates the part played by the activator in the process under discussion. The author shows that from the results obtained qualitative conclusions may be drawn concerning the mechanism of energy transfer from the lattice to the impurity atoms in the case of excitation of the crystals by hard radiation. Finally, the author thanks G. Ye. Zil'berman for supervising the investigation and

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Luminescence of Impurity Centers. II

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I. M. Lifshits for discussions. There are 2 figures and 21 references, 12 of which are Soviet.

ASSOCIATION: Khar'kovskiy filial IRYeA
(Khar'kov Branch of the IRYeA)

SUBMITTED: February 25, 1959

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Card 3/3

Z/508/60/000/000/014/018
E039/E535

AUTHORS: Ratner A.M. and Kukushkin L.S.

TITLE: On the question of the energy resolution of scintillation counters

SOURCE: III. Konference o monokrystalech. Prague, Výzkumný ústav pro minerály, 1960, 192-197

TEXT: The nonuniformity of light yield in the volume of a scintillator is one of the parameters which determines the energy resolution of scintillation counters. This paper is a continuation of previously published work and is devoted to an examination of the effect of Compton scattering of γ -quanta in crystals and the energy resolution of scintillation counters. The case of a collimated beam of γ -rays of energy 0.661 MeV (Cs^{137}) directed along the axis of a cylindrical crystal of NaI(Tl) is investigated. Crystal sizes are: no.1) $r = 20$ mm, $h = 60$ mm; no.2) $r = h = 30$ mm and no.3) $r = h = 15$ mm. Crystals no.1 and no.3 are examined for three values of refractive index, 1; 1.2; 1.77 and no.2 only for the refractive index 1.2. An accurate estimate of the energy resolution and distribution entails a cumbersome calculation and

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On the question of the energy ... Z/508/60/000/000/014/018
E039/E535

therefore the Monte-Carlo method is used. It is shown that good agreement is obtained between the calculated and experimental results. The effect of Compton scattering is to reduce the spread and lower the effect of nonuniformity of the light yield, particularly in case of the smaller crystals. If the upper part of the crystal is cut into the form of a truncated cone without decreasing the volume there is a significant increase in light yield and a decrease in the spread due to improved reflection from the sides of the crystal. For good efficiency the ratio of the height to the radius should not exceed 0.65. There are 3 figures.

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RATNER, A.M.

81903

S/126/60/010/01/005/019

E111/E335

187500

AUTHORS: Geguzin, Ya.Ye., Kovalev, G.N. and Ratner, A.M.
TITLE: Investigation of Certain Physical Processes Taking Place on the Surface of Crystalline Bodies at High Temperature. VI. Method of Determining Coefficients of Surface Self- and Hetero-diffusion in Crystalline Bodies

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol.10, No.1, pp 47 - 57

TEXT: The authors point out that comparatively little information is available on diffusion on surfaces. They describe their work to develop a method for determining the surface-diffusion coefficient and the thickness of the layer in which such diffusion occurs. The latter has been found to be thicker (Ref.3) than indicated by calculations where Fisher's model (Ref.1) was used. In their method many plates (about 100 microns thick) are made into a pack, along one polished surface of which (perpendicular to the plates) a radioactive isotope of the diffusing element is deposited (Fig.1a). There is little direct contact between

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Investigation of Certain Physical Processes Taking Place on the Surface of Crystalline Bodies at High Temperature. VI. Method of Determining Coefficients of Surface Self- and Hetero-diffusion in Crystalline Bodies

plates. Diffusion occurs both within a plate and along its gap-adjacent surfaces, and also from the latter into the plate: a characteristic distribution is obtained (Fig.1b). From this, with equations developed by the authors, the self- and hetero-diffusion coefficients can be calculated, using a simplified representation (Fig.2); graphical methods can be used (Figs.3 and 4) for calculation. The authors go on to discuss the possible role of gaseous diffusion, showing that with their size of interplate gap this cannot be significant: the critical gap width is given by the square root of the product of the surface-diffusion coefficient and the life of an atom on the wall surface. This conclusion was verified by a special series of experiments in which iron strips were arranged between two plates, one covered with a layer of Fe^{59} . Two sizes of gap were arranged between strips (Fig.5). Radioactivity of the plates was determined,

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S/126/60/010/01/005/019

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Investigation of Certain Physical Processes Taking Place on the Surface of Crystalline Bodies at High Temperature. VI. Method of Determining Coefficients of Surface Self- and Hetero-diffusion in Crystalline Bodies

excluding surface diffusion, after annealing at 680 °C. The authors report preliminary determinations of surface self-diffusion in alpha iron. Armco-iron strips 9×10^{-3} cm thick, 3×10^{-1} cm wide, were studied by the pack technique, diffusion annealing being effected in oxygen-free argon at 550, 600, 640, 650 and 680 °C. Fig.6 shows an autoradiograph of a specimen and Fig.7a the distribution of radioactivity with distance from specimen edge. Fig. 7b gives plots of functions derived from Fig.7a. Data relating to surface diffusion in alpha-iron are tabulated and the logarithm of the surface-diffusion coefficient is shown (Fig.8) to be linearly related to the reciprocal of absolute temperature. The surface-adjacent layer in which surface diffusion takes place was found to be several hundred atom layers thick: no explanation is available of the existence.

Card 3/4

RATNER, A. M.

Cand Phys-Math Sci - (diss) "Theory of luminescence of crystals containing impurity centers of glowing." /Moscow, 1961. 15 pp; (Academy of Sciences USSR, Physics Inst imeni P. N. Lebedev); 150 copies; free; bibliography on p 15 (21 entries); (KL, 6-61 sup, 195)

20777

9.4300 (1138, 1143, 1395)

S/181/61/003/003/002/030
B102/B214

AUTHORS: Ratner, A. M. and Zil'berman, G. Ye.

TITLE: Luminescence of impurity centers. III.

PERIODICAL: Fizika tverdogo tela. v. 3, no. 3, 1961, 687-697

TEXT: The band shapes of impurity absorption and luminescence and the probability of thermal (nonradiative) transitions between the discrete levels 0 and S due to the existence of impurities in the crystal were calculated in the first two parts of the paper (FTT, I, 1697, 1959; FTT, I, 1707, 1959) where the motion of ions was considered classically. The present third part of the paper gives analogous calculations; but the motion of ions is considered quantum-mechanically, and the changes in the elastic constants of the lattice on electron transitions are taken into account. For this purpose, a study is first made of the relationship between the elastic constants of the lattice distorted by the introduction of impurity atoms and the parameters characteristic of the form of absorption and luminescence bands in the classical case. It can be shown that in the case of strong coupling, the classical theory has only a small number of parameters determined by the

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Luminescence of ...

interaction of the impurity atom with its nearest neighbors. As in the classical case, at temperatures above one-fifth of the Debye temperature of the crystal, the results can be expressed by the elastic constants of the interaction of the impurity atom with its nearest neighbors. At lower temperatures, the expressions for the form of the absorption and luminescence spectra are influenced also by the law of dispersion of normal vibrations of a perfect lattice. [Abstracter's note: The important formulas are not quoted here as they contain an extraordinarily large number of quantities whose exact definition alone would exceed the normal size of an abstract.] I. M. Lifshits is thanked for his interest in the work and for discussions. There are 2 figures and 4 Soviet-bloc references.

SUBMITTED: April 4, 1960 (initially) and October 10, 1960 (after revision)

Card 2/2

20780

9.4300 (1138, 1143, 1395)

S/181/61/003/003/005/030
B102/B214

AUTHOR: Ratner, A. M.

TITLE: Luminescence of impurity centers. IV.

PERIODICAL: Fizika tverdogo tela, v. 3, no. 3, 1961, 704-712

TEXT: A discussion is given here of some special cases of the theory of absorption and luminescence band shapes developed in Ref. 1 (A. M. Ratner, G. Ye. Zil'berman, FTT, v. 3, no. 3, 687). The motion of lattice ions was considered in Ref. 1 quantum-mechanically, and the changes of the elastic constants on electron transitions was also taken into account. Here, some special cases are considered as, for example, NaCl type crystals where the band shape parameters are explicit functions of the elastic constants of the lattice. The probability of thermal transitions is also calculated considering the motion of ions quantum-mechanically. The last-mentioned quantity was calculated earlier by M. A. Krivoglaz, as well as by Cubo and Toyozawa (Progr. Theor. Phys. 13, 160, 1955) but without taking account of the changes in the elastic constants on electron transition. Since the changes in the elastic constants affect the thermal transition probability considerably,

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Luminescence of ...

the results of these authors are valid only for mirror-symmetric absorption and luminescence spectra. Here, the general case of variable elastic constants is considered. All the formulas used are taken from the earlier paper. First, the case of a lattice with a center of symmetry is considered in the case of strong coupling of the impurity electrons. It is found that the mass of the impurity ion has no effect on the luminescence and absorption spectra; the impurity ion at the center of symmetry takes part only in those lattice vibrations which remain in equilibrium on electron transitions. In the second part of the paper, the case of mirror symmetry is briefly discussed. In this case, the elastic constants of the lattice remain unchanged, and, as S. I. Pekar has shown, the band shapes are mirror-symmetric with respect to a pure electron transition. The third part deals with the case of an NaCl type lattice in which one of the lattice nodes is occupied by an impurity atom. It is assumed that this atom has maximum symmetry, and so all the three crystallographic directions are equivalent. Finally, thermal transitions are considered in the fourth part of the paper. When considering the ion motion quantum-mechanically, there is found a relationship analogous to what exists in the classical case between the probability of thermal transition and the optical characteristics of a crystal with impur-

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ity centers of luminescence. For the sake of simplicity, a transition from an excited state (s) to the ground state (0) is considered. The perturbation Hamiltonian for the transition $s \rightarrow 0$ is taken to be the difference between the exact Hamiltonian of the crystal and its energy in adiabatic approximation. For the thermal transition probability, the relation $W_{s0} = CP_s(0)$ is found, where $P_s(\omega)$ characterizes the form of the luminescence spectrum, and C lies between $10^{25}-10^{27} \text{ sec}^{-2}$. I. M. Lifshits and G. Ye. Zil'berman are thanked for their interest in the work and for discussions. N. Ye. Lushchik is mentioned. There are 2 figures and 8 references: 7 Soviet-bloc and 1 non-Soviet-bloc.

SUBMITTED: April 4, 1960 (initially) and October 10, 1960 (after revision) X

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21397

S/120/61/000/002/007/042
E032/E114

24.3300 (1051, 1106, 1141)

AUTHORS: Ratner, A.M., and Rom-Krichevskaya, I.A.

TITLE: On the theory of the energy resolution of scintillation counters

PERIODICAL: Priory i tekhnika eksperimenta, 1961, No. 2, pp. 53-56

TEXT: Consider an isotropic and optically homogeneous crystal with a carefully polished surface. The crystal is cylindrical in form but has an arbitrary cross-section (for example, circular or rectangular). The lower surface is in contact with a photomultiplier (Fig. 1) while a reflector (specular or diffuse) is placed above the upper surface. The gap between the reflector and the crystal is assumed to be small compared with the dimensions of the crystal, but large compared with the wavelength. Let n_0 be the refractive index of the crystal and n_1 the ratio of n_0 to the refractive index of the glass of the photomultiplier ($n_0 > n_1$). It will be assumed that

$$1/n_0^2 + n/n_1^2 < 1 \quad (1)$$

It then follows that the sum of the angles of total internal reflection is less than π .
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E032/E114

On the theory of the energy resolution of scintillation counters reflection from the upper and lower faces is given by

$$\theta_0 + \theta_1 = \arcsin n_0^{-1} + \arcsin n_1^{-1} < \pi/2$$

Condition (1) ensures that rays making an angle $\theta > \theta_1 = \arcsin n_1^{-1}$ with the vertical need not be considered, since such rays do not reach the photocathode (for example, ray 1 in Fig.1). Let us calculate the ratio of the light-energy reaching the photocathode to the total light-energy due to a scintillation produced at a point M. It is easy to see that ray 2, which travels in an outward direction at an angle $\theta < \theta_1$ to the vertical, will reach the photocathode after traversing a distance $z \sec \theta$, where z is the distance of the point M from the lower face. If this ray intersects the side surface, then in view of (1) it is totally reflected from it and its angle with the vertical remains the same. Ray 3, which is directed upwards at an angle θ to the vertical ($\theta_0 < \theta < \theta_1$) is totally reflected from the upper face and reaches the photocathode after traversing a distance $(2h - z) \sec \theta$ where h is the height of the crystal. Finally, ray 4 which is

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On the theory of the energy resolution of scintillation counters directed upwards at an angle $0 < \theta_0$ to the vertical leaves the crystal through the upper face, becomes reflected (specularly or diffusely), re-enters the crystal at an angle $0 < \theta_0$, and strikes the photocathode. The total light output will therefore be given by

$$J = \gamma \left\{ \frac{1}{2} (1 - \cos \theta_0) e^{-\mu h} + \frac{1}{2} (\cos \theta_0 - \cos \theta_1) e^{-\mu h (2h - 1)} + R_{\text{eff}} \frac{1}{2} (1 - \cos \theta_0) e^{-\mu h (2h - 1)} \right\}; \quad (2)$$

$$\beta_1 = \frac{1}{1 - \cos \theta_1} \ln \frac{1}{\cos \theta_1}; \quad \beta_2 = \frac{1}{\cos \theta_0 - \cos \theta_1} \times \ln \frac{\cos \theta_0}{\cos \theta_1}; \quad \beta_3 = \frac{1}{1 - \cos \theta_0} \ln \frac{1}{\cos \theta_0}$$

where μ is the absorption coefficient and R_{eff} is the effective reflection coefficient accounting for the reflection from the upper
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On the theory of the energy resolution of scintillation counters face of the scintillator and from the reflector. The constant γ , which is usually close to unity, represents Fresnel reflection from the lower face. In the case of a diffuse reflector

$$R_{\text{diff}} = \frac{R(n_0) + \lambda [1 - R(n_0) - \tilde{R}(n_0)]}{1 - \lambda \tilde{R}(n_0)} \quad (3)$$

where λ is the reflection coefficient at the surface of the reflector. In the case of a specular reflector we replace $R(n_0)$ in Eq.(3) by $R(n_0)$. Here R is the average value of the Fresnel reflection coefficient and $\tilde{R}$ has a similar meaning but takes into account the angular distribution of the diffusely reflected rays. The values of these coefficients are given in the Table:

n	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
R(n)	0.00	0.04	0.065	0.08	0.09	0.10	0.11	0.125	0.135
$\tilde{R}(n)$	0.00	0.025	0.04	0.055	0.07	0.085	0.10	0.115	0.13

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EO32/E114

On the theory of the energy resolution of scintillation counters
The coefficient γ is given by

$$\gamma = 1 - R(n_1) + \frac{R(n_1)}{1 - \cos \theta_1} [(\cos \theta_0 - \cos \theta_1)e^{-2\beta_2 \mu h} + R_3 \phi \phi_1 (1 - \cos \theta_0)e^{-2\beta_3 \mu h}]$$

It follows from Eq.(2) that provided Eq.(1) is satisfied, the light output of a crystal in the form of a right cylinder with polished walls is determined by the quantity $\kappa = \mu h$ and does not depend on the form at the base of the cylinder. The light output depends only on the single coordinate z . Fig.2 shows the function $J = J(z)$ for $\kappa = 0.2$ and $\kappa = 2$. Eq.(2) can be used to determine the function $\phi_0(J) = dV/dJ$ where V is the volume. For point scintillations, and for scintillations distributed uniformly throughout the crystal, it is found that

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1032/E114

On the theory of the energy resolution of scintillation counters

$$\rho_0(J) = \frac{dV}{dJ} = \text{const} / [\beta_1 (1 - \cos \theta_1) e^{-\mu \beta_1 z} - \beta_2 (\cos \theta_0 - \cos \theta_1) e^{-\mu \beta_2 (2z - z)} - \beta_3 (1 - \cos \theta_0) e^{-\mu \beta_3 (2z - z)}], \quad (4)$$

where z must be looked upon as a function of J in accordance with Eq.(2). The half-width of this curve (Eq.4) is usually very small but the sharp peak is usually spread out due to the photomultiplier spread which is usually described by

$$\rho(J) = \int_{J_{\min}}^{J_{\max}} \exp \left[- \frac{(J - J')^2}{a^2} \right] \rho_0(J') dJ' \quad (5)$$

Figs. 3 and 4 show the $\rho(J)$ curves computed from Eq.(5) for a sodium iodide crystal ($n_0 = 1.8$, $n_1 = 1.2$). Fig.3 corresponds to Card 6/11

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E032/E114

On the theory of the energy

$\kappa = 0.2$ and Fig. 4 to $\kappa = 2$. In these figures the dashed curves correspond to the case $R_{\beta\phi\phi} = 0.952$, while the continuous curves correspond to $R_{\beta\phi\phi} = 0.72$. Curves 1, 1' were calculated without taking into account the photomultiplier spread, while curves 2, 2' are corrected for this spread. The half-width of the photomultiplier spread is assumed to be 5% for a light output of 0.5. If the reflection coefficient λ of the reflector is equal to unity, then Eq. (2) can be replaced by

$$J = \gamma(1 - \cos \theta_1) e^{-\mu\beta_1 h} \operatorname{ch} \mu\beta_1(h - z), \text{ so that}$$

$$\rho_0(J) = \operatorname{const}(J^2 - J_{\min}^2)^{-1/2} = \operatorname{const}(J + J_{\min})^{-1/2}(J - J_{\min})^{-1/2} \quad (6)$$

Substituting Eq. (6) into Eq. (5), and carrying out the integration, one obtains the following approximate formula

$$\rho(J) = \frac{0.612}{\sqrt{\alpha} A} \int_0^{1.538 \sqrt{\alpha}} \exp \left\{ -\frac{1}{2} \left[u^2 - 2.36 \frac{J - J_{\min}}{.1} \right]^2 \right\} du, \quad (7)$$

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Eq. (7) on page 56 attached to 11371

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On the theory of the energy

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(which is normalized to a unit area), where

$$\alpha = \frac{J_{\max} - J_{\min}}{A}, \quad J_{\min} = \gamma(1 - \cos \theta_1)e^{-\mu\beta_1 h},$$

$$J_{\max} - J_{\min} = \frac{\gamma}{2} (1 - \cos \theta_1)(1 - e^{-\mu\beta_1 h})^2 \quad (8)$$

Fig.5 shows the function $\rho(J)$ for the following values of α : 0, 0.5, 1, 2, 3, ∞ (curves 1-6 respectively) where $A = 1.67a$ and is the half-width of the photomultiplier spread correction.

Acknowledgements are expressed to G.Ye. Zil'berman for discussing the results.

There are 6 figures and 3 references: 2 Soviet and 1 English.

ASSOCIATION: Khar'kovskiy filial Vsesoyuznogo nauchno-issledovatel'skogo instituta khimicheskikh reaktivov (Khar'kov Branch of the All-Union Scientific Research Institute for Chemical Reagents)

SUBMITTED: March 7, 1960

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On the theory of the energy

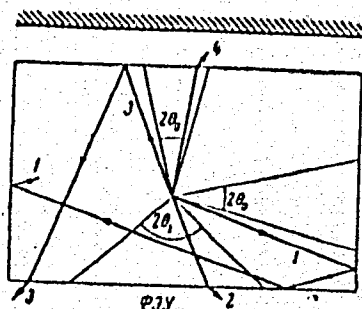


Рис. 1. К выводу формулы для световыходя

Fig. 1

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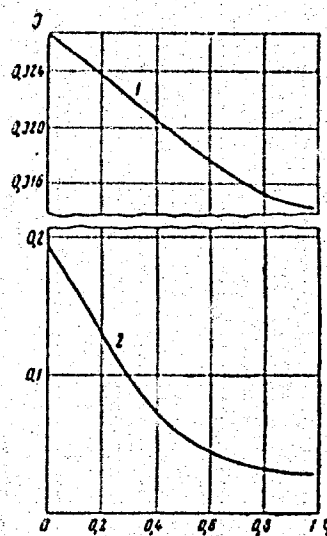


Fig. 2

On the theory of the energy

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E032/E114

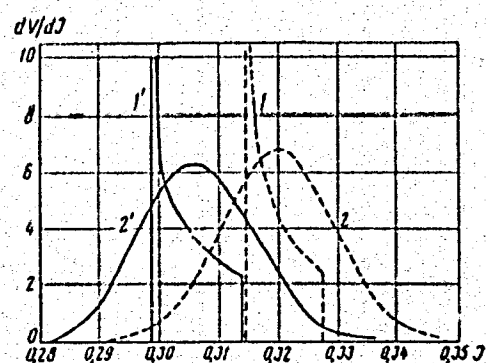


Fig. 3

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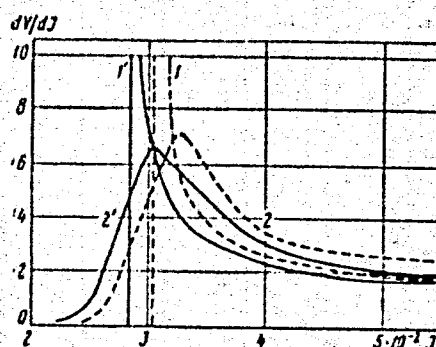


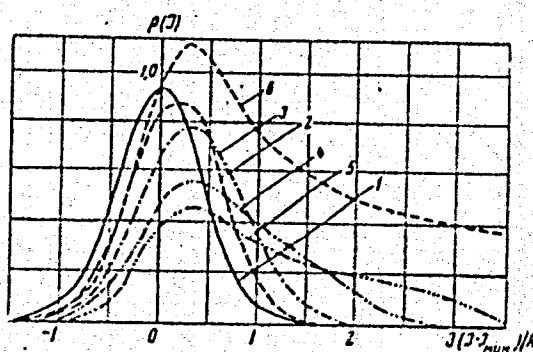
Fig. 4

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Fig. 5



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Fig. 5 on page 25 of document S/120/61/000/002/007/042

22190

S/048/61/025/004/039/048
B117/B209

24,3500

AUTHORS: Ratner, A. M. and Zil'berman, G. Ye.
TITLE: Theory of the luminescence of activated phosphors
PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya,
v. 25, no. 4, 1961, 537-539

TEXT: The present paper has been read at the 9th Conference on Luminescence (Crystal Phosphors) and is devoted to the theory of luminescence of crystal phosphors. S. I. Pekar and M. A. Krivoglaz (Refs. 1 to 3: Zh. eksperim. i teor. fiz., v. 22, 641 (1952); Tr. In-t fiz. AN USSR, no. 4, 37 (1953); Zh. eksperim. i teor. fiz., v. 25, 191 (1953)) have calculated the optical characteristics of impurity luminescence centers as well as the probability of thermal transitions, basing on the assumption that the elastic moduli of the lattice are conserved during an electron transition. However, this assumption is usually not fulfilled when the electrons of the impurity atom are strongly bound. This fact follows from the deviation from the law of mirror symmetry. The authors of the present paper have previously calculated the shape of absorption

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Theory of the luminescence ...

and luminescence bands of impurity centers as well as the probability of thermal transitions, taking into account the change in the elastic moduli of the lattice during an electron transition. In the classical case ($kT \gg \hbar \omega_D$; ω_D - Debye crystal frequency) the variables q_i are introduced in the calculation of the optical characteristics. The formulas for the potential energy of the lattice in the ground and in the excited state are rendered into the diagonal form simultaneously;

$$U_0 = \frac{1}{2} \sum_{i=1}^N K_i q_i^2, \quad U_s = E^{(0)} + \frac{1}{2} \sum_{i=1}^N K'_i (q_i - q_{0i})^2 \quad (N \text{ denotes the}$$

number of degrees of freedom of the crystal lattice; the variables q_i are no normal lattice coordinates). It can be shown that in the case of a strong bond only the first M of the q_{0i} differ from zero, and that $\delta_1 = (K_1 - K'_1)/K_1$, where M is of the order of several units. The quantities K_α , K'_α , and $q_{0\alpha}$ ($\alpha = 1, \dots, M$) are determined immediately by the interaction of an impurity atom with its nearest neighbors; they

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Theory of the luminescence ...

express optical characteristics of impurity luminescence centers and the probability of thermal transitions. The change in the elastic moduli during an electron transition leads to a violation of mirror symmetry and to a deviation of the absorption and luminescence bands from Gaussian shape. This change has a considerable effect on the probability of thermal transitions. In a quantum-mechanical treatment of ion motion, the calculation of the optical characteristics requires the use of normal lattice constants that do not coincide for the individual electron states of the impurity atom. The results are simplified in the classical case, as they are then expressed by the variables K_a , K'_a , and q_{0a} used in the classical case. The authors have found that at temperatures $kT > 1/5 \hbar \omega_D$, just like in the classical case, the optical characteristics are expressed by the elastic moduli of the interaction of an impurity atom with its nearest neighbors, and that these characteristics are not directly related to the lattice vibrations. In particular, local vibrations do not have any effect upon the shape of absorption and luminescence bands. At low temperatures, the dispersion law of normal vibrations (corresponding to a perfect lattice) is predominant. In the discussion about this paper,

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22190

Theory of the luminescence ...

S/048/61/025/004/039/048
B117/B209

K. K. Rebane among other things points out the fact that in his papers he has given formulas obtained on the basis of quantum-mechanical calculations taking the superimposition of normal vibrations into account and which are valid for any temperature. He also suggested to subject the conclusions, drawn by the authors as to the insignificant role of local vibrations, to a test by means of these formulas. There should be cases in which local vibrations do play an essential part. [Abstracter's note: Essentially complete translation.] There are 7 Soviet-bloc references.

Card 4/4

18 8100

S/126/62/013/002/006/019
EO32/E314

AUTHORS: Ratner, A.M. and Geguzin, Ya.Ye.

TITLE: Study of the origin of diffusion activity of crystalline bodies with defects. VI. On the effective diffusion coefficient in polycrystalline bodies

PERIODICAL: Fizika metallov i metallovedeniye, v. 13, no. 2, 1962, 214 - 218

TEXT: It is pointed out that the true diffusion coefficient should depend not only on the presence of a network providing paths of easy diffusion displacement of atoms but also on the presence of individual macroscopic defects such as pores and cracks. The authors discuss in the present paper the diffusion of matter (in the special case - a tracer isotope) in polycrystalline bodies with a developed network of intergrain separation boundaries. It is assumed for simplicity that the diffusion coefficient along these boundaries D_s is independent of the structural properties of the boundaries. Since this

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S/126/62/013/002/006/019
EO32/E314

Study of the origin of

coefficient is assumed to be considerably greater than the body-diffusion coefficient D_v , the material diffuses mainly along the boundaries and only "leaks through" into the grains. Two limiting cases are examined, namely, $\Delta \gg \ell$ and $\Delta \ll \ell$, where ℓ is a characteristic linear dimension of a grain and Δ is the depth of penetration of the material into the body of the grain during a particular experiment. Expressions are derived for the effective diffusion coefficient of the polycrystalline body in terms of the statistical properties of the distribution of the above boundaries and the coefficient D_s .

An estimate is also made of the upper limit for the linear dimensions of a pore or crack, for which the effective diffusion coefficient remains unaffected. There are 3 figures.

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Study of the origin of

S/126/62/013/002/006/019
E032/E314

ASSOCIATION: Vsesoyuznyy institut monokristallov i
stsintillyatorov, Khar'kovskiy gosuniversitet
(All-Union Institute of Single Crystals and
Scintillators, Khar'kov State University)

SUBMITTED: March 27, 1961

✓c

Card 3/3

L 38498-00 FED/EWT(1)/EEC(k)-2/T/ENF(k) IJP(c) WG
ACC NR: AR6019905 SOURCE CODE: UR/0275/66/000/002/A061/A061
AUTHOR: Ratner, A. M.
TITLE: Spatial distribution of radiation in the resonator of a laser 66
SOURCE: Ref zh. Elektronika i yeye primeneniye, Abs. 2A411 13
REF SOURCE: Fiz.-tekhn. in-t nizk. temperatur AN USSR Khar'kov, 1965, 28 str., ill.,
bibliogr. 9 nazv.
TOPIC TAGS: laser radiation, laser, electromagnetic field, laser resonator
ABSTRACT: The spatial distribution of the electromagnetic field and the diffraction
losses in a resonator with an active medium have been studied. Bibliography of 9
titles. A. R. [Translation of abstract] [KP]
SUB CODE: 209/ SUBM DATE: none

Card 1/1 ZC

UDC: 621.387.325

ACCESSION NR: AP4009112

S/0056/63/045/006/1908/1918

AUTHOR: Ratner, A. M.

TITLE: Oscillations in the radiation from a laser

SOURCE: Zhurnal eksper. i teoret. fiziki, v. 45, no. 6, 1963, 1908-1918

TOPIC TAGS: laser, laser radiation, stimulated emission, spontaneous emission, laser radiation intensity, finite size laser

ABSTRACT: The oscillations in the intensity of the directional radiation from a laser with reflectors of finite size are treated, in contrast to earlier work, with account taken of the dependence of the amplification coefficient on the frequency of the light. The related time variation of the output spectral composition is also dealt with. An equation is derived from the time dependence of the radiation intensity of the laser. It is shown that account of this time dependence leads to a new damping mechanism for the oscillations.

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ACCESSION NR: AP4009112

The solution of the equation is obtained for two extreme cases, small and large oscillation amplitudes. The large oscillations are non-sinusoidal, and their waveform and period are determined. The seemingly anomalous result that energy dissipation is necessary for the oscillations is explained. Orig. art. has: 5 figures and 34 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut nizkikh temperature AN UkrSSR (Physicotechnical Institute of Low Temperatures, AN UkrSSR)

SUBMITTED: 23Apr63

DATE ACQ: 02Feb64

ENCL: 00

SUB CODE: PH, SD

NO REF SOV: 003

OTHERS: 04

Cord

2/2

ACCESSION NR: AP4009929

S/0057/64/034/001/0115/0121

AUTHOR: Ratner, A.M.

TITLE: Laser excitation threshold

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.1, 1964, 115-121

TOPIC TAGS: laser, laser excitation, laser pumping, laser threshold, two-level laser, Stokes shift laser, three-level laser, four-level laser

ABSTRACT: The minimum pumping power required for laser operation (laser oscillation threshold) is calculated for arbitrary shape and relative position of the impurity absorption and emission bands corresponding to the working transition. The derivation is based on the following assumptions: 1) the concentration of impurity centers is so small that they do not interact; 2) the absorption and emission bands corresponding to the working transition do not overlap any other optical bands; 3) the sum of the populations of the two electron states corresponding to the working transition is constant. Assumption 3) is valid for any two-level (Stokes shift) laser; it is also valid for a three- or four-level laser provided the idle transition probabilities are sufficiently great that the populations of the extra levels

Card 1/2

RATNER, A.M.

Threshold pumping power of a laser. Zhur. tekhn. fiz. 39 no.1:115-121
Ja '64. (MIRA 17:1)

1. Fiziko-tekhnichskiy institut nizkikh temperatur AN UkrSSR, Khar'kov.

RATHEN, A.M.

Polarization of laser radiation. Opt. i spektr. 18 no.2:258-266
F 165.

(MIRA 18 4)

L 63381-65 EWA(k)/FBD/EWT(1)/EWP(e)/EWT(m)/EEC(k)-2/EWP(1)/T/EWP(k)/EWP(b)/
EWA(m)-2/EWA(h) SCTB/IJP(c) WG/WH

ACCESSION NR: AP5019761

UR/0051/65/019/002/0264/0269
621.375.9:535

AUTHOR: Rom-Krichevskaya, I. A.⁴⁴; Ratner, A. M.⁴⁴; Meshcheryakov, A. V.⁴⁴

TITLE: Threshold power of a laser with misaligned optical system

SOURCE: Optika i spektroskopiya, v. 19, no. 2, 1965, 264-269

TOPIC TAGS: solid state laser, neodymium laser, glass laser, laser optics, laser alignment

ABSTRACT: The authors determine the threshold pump power of a solid-state laser having an angular beam spread on the order of 10-20' and a misaligned optical system (which includes the tested rod), and the influence exerted on the threshold power by the condenser lens placed in front of one of the mirrors confocally with the rod. A laser system is considered whose principal elements are the rod, plane mirrors, and a condenser lens. Such a system has been shown previously to be equivalent to a system with confocal spherical mirrors. The misalignment of the optical system may be due to a relative tilt of the optical axes of the mirrors, or to inaccurate finish of the rod. The maximum tilt angle under which laser action remains unaffected is determined by simple geometric optics calculations. Experiments were

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L 63381-65

ACCESSION NR: AP5019761

made with a neodymium-glass laser operating at 1.06μ wavelength, the rods tested being 70 mm long and 6--8 mm in diameter. The experimental results show that the permissible tilt angle is directly proportional to the resolution of the lens used in the experiment, so that the effect of optical misalignment can be compensated by using a proper lens. The maximum tilt angle is found to be approximately $d/2F$, where d is about half the rod diameter and F the focal length of the lens. Some advantages of a system with flat mirrors and a lens over one with spherical mirrors are indicated. It is also shown that by testing the laser with a set of several lenses it is possible to determine the degree of inhomogeneity of the rod. "The authors thank N. L. Kramarenko for preparing the multilayer reflecting coatings." Orig. art. has: 3 figures and 8 formulas. [02]

ASSOCIATION: none

SUBMITTED: 04 May 64

ENCL: 00

SUB CODE: EC, OP

NO REF SOV: 002

OTHER: 005

ATD PRESS: 4080

Card 2/2

L 45017-66 ENT(1)/ESC(k)-2/T/ENT(k) IJP(c) WG/1D

ACC NR: AT6015138

SOURCE CODE: UR/0000/66/000/000/0150/0165

AUTHOR: Ratner, A. M.

ORG: Physico-Technical Institute of Low Temperatures, AN UkrSSR (Fiziko-
tekhnicheskii institut nizkikh temperatur AN UkrSSR)

TITLE: Characteristics of laser radiation under stationary and relaxation conditions

SOURCE: Respublikanskiy seminar po kvantovoy elektronike. Kvantovaya elektronika
(Quantum electronics); trudy seminar. Kiev, Naukova dumka, 1966, 150-165

TOPIC TAGS: laser, laser theory, *LASER RADIATION SPECTRUM*

ABSTRACT: Laser characteristics in their monotonous-variation region that precedes the stationary operation are theoretically investigated for a multimode case, when the spectral distribution of the radiation can be assumed continuous. The integral radiation intensity, its spectrum and polarization are considered. The calculations are based on a 4-level model, but are equally applicable to 3-level lasers. An integral equation describing the radiation time characteristic is set up, and integral formulas for two polarization components are derived. These formulas

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1. 4417-66

ACC NR: AT6015138

(representing generalized T. H. Maiman's formulas) are used for investigating laser stationary operation. Two transient cases — weak and strong optical anisotropy — are also analyzed. The above theory is applicable to all cases where the generation time is: $t \ll \frac{1}{\omega_1} \left(\frac{2AL}{\omega_0 \lambda} \right)^2$, where λ is the wavelength, L is the distance between mirrors, λ_1 is the excited-atom concentration. Orig. art. has: 3 figures and 57 formulas.

SUB CODE: 20 / SUBM DATE: 12Feb66 / ORIG REF: 007 / OTH REF: 004

Card 2/2

fv

L 46016-95 ENT(1)/ENC(k)=2/T/ENT(k) IJ(c) WD/WD
ACC NR: AT6015139 SOURCE CODE: UR/0000/66/000/000/0166/0182

AUTHOR: Ratner, A. M.

ORG: Physico-Technical Institute of Low Temperatures, AN UkrSSR (Fiziko-tehnicheskii institut nizkikh temperatur AN UkrSSR)

TITLE: Laser Q-switching by means of nonlinear effects in absorbing media

SOURCE: Respublikanskiy seminar po kvantovoy elektronike. Kvantovaya elektronika (Quantum electronics); trudy seminar. Kiev, Naukova dumka, 1966, 166-182

TOPIC TAGS: laser, laser theory, laser R and D, pulsed laser, laser modulation

ABSTRACT: A theoretical investigation is presented of the processes transpiring in a 4-level laser that contains a Q-switching absorbing medium. The behavior of the

optical shutter is described by this parameter: $r = \frac{\pi \tau}{g n} \sqrt{\frac{\nu \mu}{g \theta}} \approx \frac{T}{0 \sqrt{g}} \cdot \frac{\tau \Delta \omega \mu}{T \Delta \omega \mu_{max}} \sqrt{\nu \mu \theta}$. In

this formula, the first cofactor is about unity, the second much smaller than, and the third much greater than unity. Hence, r varies in a wide range depending on the relations between the second and third cofactors. The maximum relative excess of

threshold concentration is: $z(t_1) = -\frac{\delta \bar{n}}{\bar{n}} = -\frac{b \gamma}{g}$. The optical shutter opens under the

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